1877.

BOROUGH OF CARDIFF.

THE

OFFICER OF HEALTH'S REPORT

ON

Sanitary Condition of Cardiff

DURING THE YEAR 1876.

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1877.

TO THE

Cardiff Urban Sanitary Authority.

Cardiff, April, 1877.

GENTLEMEN,

In the last Annual Report made to your Board I described the area of the enlarged Urban Sanitary District of Cardiff to be 7,354 acres, exclusive of that portion covered by water. For Sanitary purposes I sub-divided this into the Wards constituted by "The Cardiff Improvement Act, of 1874," as follows :—

Cardiff Sub-division	...	...	...	2,300 acres
Roath ,,	...	...	...	3,500 ,,
Canton ,,	...	...	...	1,574 ,,

I then entered somewhat elaborately into the existing state of the drainage, its geological conformation, and other matters bearing collaterally on the public health. The drainage of the sub-division of Cardiff I described as being carried out on a system originally designed by Mr. Hawkshaw, with such modifications as were, from time to time, necessitated by attendant circumstances, under Mr. T. Waring, your then Surveyor. Since 1875, the sewerage of Richmond Terrace and its immediate neighbourhood has been completed, and the requirements of this portion of the Town up to the present time met.

A large portion of Roath had also been completed under Mr. Waring, but the rapidity with which this portion of your district is increasing, occasioned a considerable amount of sewerage works to be carried out during the past year, and the following Streets and localities have been provided for in the Eastern portion of Roath :—

Fox Lane,
Fox Street,
Booker Street,
Tyler Street,
Richards' Lane, with a sewer of 3 ft. x 2 ft., internal diameter,
Theodore Street, and
Maud Street, with a sewer somewhat larger, this having an internal diameter of 3 ft. 3 in. x 2 ft.

In the vicinity of Adamsdown, new sewers have been constructed as follows :

Adamsdown Place
Kanes Place
Garesfield Street
Clyde Street
Prince Leopold Street
Galston Street
Longcross Place

These have an internal diameter of 3 ft. 3 in. x 2 ft., and at depths varying from 11 ft. 6 in. to 7 ft. below the surfaee of the ground.

All these new sewers are eonnected with the main scwers in the immediate neighbourhood.

The Western or Canton district I reported last year as being practically undrained, the then exisiting drains being merely surfaee, and very limited in extent. The then proposed new system of drainage has been rapidly earried out under the supervision of Mr. Williams, your present Surveyor, and is now nearly eompleted. This system may be deseribed as follows:—The main trunk sewer eommenees at Lower Grange and terminates at Canton Cross. It has an internal diameter of 4 ft., with gradients of 1 in 1,700 and 1 in 1,500.

From this main sewer, a lateral braneh has been eompleted of 3 ft. 3 in. x 2 ft., internal diameter, passing through the land known as Well's Charity to Wyndham Street, on the site of intended new Streets, with a gradient of 1 in 1,500, and 1 in 300 at the Northern end, and is laid at an average depth of 12 ft.

A sewer has also been made of the same dimensions in Wyndham Street, Lewis Street, and Heath Street, with gradients varying from 1 in 150 to 1 in 100, at an average depth of 8 ft. 6 in.

A new sewer of similar size has been made in South Morgan Street, discharging into Wyndham Street, with a gradient of 1 in 200, in lieu of the old pipe drain whieh was only intended for surfaee water.

From the end of main trunk sewer No. 1, a sewer has been eompleted 3 ft. 9 in. x 2 ft. 6 in., internal diameter, to Brook Street, with a gradient of 1 in 190, and connected with the sewer in that Street; the portion of the sewer from that point to the temporary outfall into the River Taff being abandoned and taken up.

A new sewer 3 ft. 3 in. x 2 ft., internal diameter, has been made from near Canton Cross, passing along the Cowbridge Road to Severn Road, and eonneeted with the existing sewer in that Road, having a gradient of 1 in 450.

A braneh sewer has been constructed from the above sewer in front of the Cross Inn to the entranee to Union Street, and the pipe drain in that Street has been conneeted with it.

A new sewer has been eompleted passing along the Llandaff Road from Canton Cross (at which point it forms a junction with the main trunk sewer) to the Elms, this has a diameter of 3 ft. 3 in. x 2 ft., with a gradient throughout of 1 in 170. Lateral branches have been eonstructed to the Canton Market.

A continuation of the main sewer has been made from the termination of the main trunk sewer at Canton Cross to Harvey Street, and orders have been given to extend it to Clive Road. This sewer is 3 ft. 9 in x 2 ft., internal diameter, and has a gradient af 1 in 1,309.

Arrangements are being made for the drainage of Harvey Terraee, Evans' Terrace, and Leckwith Road to Canton Common, at an early period.

In the South portion (Grangetown), the following sewers have been constructed during the past year:—

Ludlow Street
Bromfield Street
Bradford Street
Newport Street
Cambridge Street
Bromsgrove Street
Herbert Street

All these sewers have an internal diameter of 3 ft. 3 in. x 2 ft., and are laid at depths varying from 14 ft. to 7 ft. below surface of the ground, with a gradient of

The sewers of the Canton and Grangetown district are connected with the main sewers executed by the Trustees of Lord Windsor which commence at or near mouth of the River Taff, extending in a North Western direction through Amherst Street and Knowle Street. The sewers vary from 3 ft. 9 in. x 2 ft. 6 in. to 2 ft. 3 in. No provision for flushing these sewers has been found necessary, the storm water and fall being sufficient; on examination, there has been found little or no deposit in these sewers.

I have to recommend to your Board the expediency of enforcing house communication with these sewers with as little delay as possible.

THE METEOROLOGY.

The Meteorology of the year was as follows—the Rainfall at Cardiff for 1876 as observed by Mr. W. Adams, C.E., F.G.S., at his residence, 53, Crockherbtown, is shewn by subjoined Table:—

Latitude, N. 51° 29' 10"
Longitude, W, 3° 9' 55"
Diameter of Receiver, 5 inches
Height above ground, 1 foot
Height above mean water level, 35 feet.

Month.	Total depth.	Greatest fall in 24 hours.	Date.	No. of days on which ·01 or more fell.
	Inches.			
January	1·91	0·68	2nd	12
February	5·33	0·90	14th	22
March	3·92	0·54	9th	22
April	2·70	0·38	28th	17
May	0·23	0·12	24th	4
June	1·91	0·52	15th	9
July	1·24	0.41	6th	10
August	6·06	2·72	19th	11
September	7·08	1 28	30th	19
October	3·84	0·62	16th	17
November	5 27	0·75	12th	18
December	7·13	0·80	17th	23
	46·62	.....	.....	...

The total rainfall in 1876 was 4·70 inches above the average of the previous five years, as is shown below :—

	1872.	1873.	1874.	1875.	1876.
	Inches.	Inches.	Inches.	Inches.	Inches.
January	7·79	4·76	4·63	5·87	1·91
February	4·24	1·17	2·91	2·08	5·33
March	3·16	3·60	2·03	1·66	3·92
April	1·83	0·39	1 67	2·65	2·70
May	2·11	2·72	0·67	2 93	0·23
June	3·71	1·93	1·71	5·34	1·91
July	4·67	4·03	1·78	6·27	1·24
August	3·12	3·66	4 57	3·82	6·06
September	3·67	2·75	5·45	4·05	7·08
October	4·45	4·42	4·83	7·80	3·84
November	5·56	2·29	2·71	7.78	5 27
December	6·05	1·16	4·35	1·74	7·13
	50·36	32·88	37·31	51·99	46·62

The monthly summary of the metcorological observation shows that January was fine, with moderate frost, and not too much rain, being considerably less than any of the previous five years. The barometer was high, and the range not extreme. The temperature was variable and rather above the average. There was frost on 13 nights. Easterly winds were predominant. Fogs and mists caused the air to be damp, but the rainfall was only 1·91 inch, and it fell on 12 days.

February, with the exception of a cold dry period of 10 days duration, was extremely wet and stormy, with low and variable barometer. The mean temperature was generally high and above the average. There was frost on 10 nights. The prevailing winds were chiefly westerly and very stormy. The rainfall was heavy, and distributed over 22 days. It measured 5·33 inches, and caused high floods.

March was very variable as to weather. The barometer was low and unsteady, with a wide range. The temperature was uncertain, but near an average on the whole. The winds were northerly and westerly, and tempestuous. The rain was spread over 22 days, and amounted to 3·92 inches.

April was an average month, with mingled sunshine and shower. The barometer was low and fluctuated much. The temperature was rather above the mean, the rainfall, 2·70 inches; it fell on 17 days. Northerly winds predominated, and there was frost on 3 nights.

May was chilly and ungenial, with a heavy, cold, polar, current. The barometer was high, and the thermometer low. The air was dry and keen, and checked vegetation, nipping the foliage of the trees. The temperature was below the average. The prevailing winds were easterly, and the rainfall was only 0·23 inch, and fell on 4 days.

June was fine and dry and, for the most part, clear. The barometer was moderately high and steady. The temperature was near the average. The winds were nearly equally divided among the four quarters. The rainfall was again light, measuring only 1·91 inches, which was spread over 9 days.

June was very fine and hot. The barometer high and steady. The temperature was usually warm. The maximum reading was 90° in the shade. The mean temperature was 3·6° above the average. The winds were chiefly South West. The rainfall was deficient, and guaged only 1·24 inches, distributed over 19 days.

August was fine, hot, and clear, with severe local thunderstorms. It was a good harvest month. The barometer was rather high and the range a little more than an inch. The temperature was above the average. The winds were Westerly. The rainfall was 6·06, distributed over 11 days.

September was very wet and stormy, with a low, and unsteady barometer. The mean temperature near the average. The prevailing winds North West. Rainfall, 7·08 inches, distributed over 19 days.

October was soft, mild, and very wet up to the 18th, when it became fine. The barometer was low and fluctuating. The winds were South East. The atmosphere damp and misty. The rainfall was 3·84 inches, spread over 17 days. There were some floods.

November was very fine up to the 11th, then changing and becoming very wet with much mist and fog. The weather was open and the herbage continued very green. The barometer oscillated through a range of rather more than an inch, and was low after the 10th. The temperature was mild and variable. The winds were from the South and East with much force. The rainfall was 5·27 inches, and fell on 18 days.

December was mild, wet, and stormy, with heavy floods. The barometer was unusually low and disturbed. The prevailing winds South and West. The rainfall was 7·13 inches, and fell on 23 days The temperature was very high, for the season, with a limited range.

THE WELL WATER OF CARDIFF AND ITS POLLUTIONS.

In the report which I made to your board for the year 1875, I alluded to the circumstance that 282 houses in the subdivision of Canton, alone, were supplied by water obtained from shallow wells, that many obtained a similar supply in Roath, and a few in Cardiff. During the past year my attention has been directed to the quality of the water in those wells, and as proceedings in very many instances have been taken before the magistrates for the peremptory closing of these, I propose in this report to enter into the subject of water pollution, and that I may enable you to form an estimate of the relative qualities of the samples of water obtained from these wells, I shall direct your attention to what has been considered a recommended standard of purity of water, and also a standard showing the limit of impurity, beyond which water should be absolutely condemned. The physical essentials of a pure and wholesome water are that it should be clear, palatable, somewhat ærated, and free from smell, or any deposit whatever.

All supplies of fresh water are obtained from the condensation of the aqueous vapour disseminated throughout the atmosphere. As that vapour is obtained by evaporation from the surface of the sea, rivers, ponds, and from every moist surface, it carries with it more or less of

the gases, and organic putrescent vapours which are given off from stagnant pools, sewers, manure heaps, &c. When the aqueous vapour becomes condensed in the higher region of the lower strata of the atmosphere, it falls in the form of rain, bringing with it more or less impurities, which are both dissolved and suspended therein. This quantity of impurity is naturally much augmented in rain water collected in large towns.

Rain water which falls on good gathering grounds in the open country, at the moment of reaching the earth contains but little animal matter, and the organic matter is also trifling, but there is always a slight quantity present. The amount of *nitrogen in the form nitrates and nitrites* has been estimated by Gilbert, Lawes and others, at 0.32 per 100,000, and in calculating the *previous sewage or animal contamination* this 0.32 has to be deducted from the quantity of nitrogen, in the form of nitrates and nitrites, found. When rain descends on the earth, it comes in contact with various animal matters, differing in constitution according to the geological nature of the substrata, and also the nature of the soil which covers it. The constituents which enter into solution in rain water by the assistance of carbonic acid, dissolved therein, or without the aid of such, are correctly termed the natural constituents of a water. Rain falling upon the rocky strata, which withstands the action of the atmosphere, usually contains little animal matter, and is soft in character; while water, which falls upon disintegrating rocky matter, such as limestone, &c., are more highly charged, especially if much free carbonic acid be present in the water. The natural constituents of potable water are chiefly *carbonate of lime, sulphate of lime, carbonate of magnesia, chloride of sodium, chloride of potassium, and traces of silicia.* Carbonate of lime is practically insoluble in water, and without the aid of free carbonic acid cannot be present in quantities more than 4 to 6 parts in 100,000, but by the aid of free carbonic acid 40 parts per 100,000 may be held in solution. This quantity however is derived only when the water rises from some depth below the earth's surface, where it meets with carbonic acid under pressure. Water left exposed to the air, gradually loses the free carbonic acid (becomes de-ærated), and the lime is partly precipitated. The same thing happens when water is boiled, free carbonic acid is driven off, and the carbonate of lime separated,—the hardness of such water is therefore removed by boiling. *Sulphate of lime* is very abundant in nature (not to much extent in Wales). It is much more soluble than the carbonate, and remains in solution after boiling. It exists in a fibrous and crystaline condition, as hydrated sulphate of lime, which is soluble to the extent of 1 part in 500, so that a water saturated with this might contain 200 parts per 100,000. *Carbonate of magnesia* is also plentiful in nature, in the form of dolomitic lime stone, conglomerate, &c. This is also held in solution by carbonic acid, and is somewhat more soluble than carbonate of lime, while it follows the same changes by exposure to the air and boiling. The Rhœtic formation (Penarth formation) contains much magnesia, and it is present in all the strata in and around Cardiff save the blue lias, which contains none.

Chloride of Sodium in natural water, or rather from natural sources, is always present in small quantities, from 1 to 2 parts per

100,000. In the sea shore, especially the open ocean, this quantity is often exceeded, for instance, near a sea coast bearing S. or S.W.—the prevailing point in this country—the chloride of sodium found in a natural state would be almost entirely derived from sea spray, owing to the winds carrying the spray inland, some of which reaches the most central part of our Island. The large quantity of chloride of sodium in some mineral waters, such as Llandrindod, may be, possibly sent up by subterranean agencies, some of these waters containing all the other elements of sea water, as iodine, which is not found in natural waters, except when the sea water gets inland through porous strata, or sea spray is carried in large quantities (which is not the case on the shores of the Bristol Channel from Swansea northwards), there is no other natural source of chlorine other than the pressure of some soluble chlorine salt in the substrata. This is not the case in this neighbourhood as there is no natural source of chloride of sodium in or around Cardiff. It must be remembered that the gravel under Cardiff is not a marine, but a fresh water, or river, deposit, therefore chloride of sodium can only be derived from sewage sources, if present in excess in the waters of the Cardiff Sanitary District. Chloride of potassium exists in small quantity in water, and is derived from the same sources as the chloride of sodium. Silica is held in solution as silicic acid in some natural waters notably those highly charged with carbonates, the Water Works Company's supply contains some (water from the mountain lime stone), and it is also present in water from the lias formation.

The *unnatural* constituents of water, which are derived from animal and sewage sources are, (in addition to those already enumerated) nitric acid, in combination with lime, magnesia, soda, or potash, chloride of calcium, alkaline carbonates (from washing soda), phosphates, solely from sewage when found in town water, and sulphates and magnesium salts derived from the mineral constituents of food. Some natural waters contain much organic matter in solution, so much, in fact, as to give them a distinct yellow or brownish colour. This is chiefly derived from bogs and marshy situations, and is not regarded as deleterious by Dr. Frankland. Wanklyn says these waters accelerate diarrhœa. No nitrates are however present.

The considerations respecting the quantity, &c., of total *solid matter, organic carbon and nitrogen, albuminoid ammonia, free ammonia, nitrogen as nitrates and nitrites, previous sewage contamination, chlorine, and hardness*, are such that I wish to draw your attention to, as the quantities of these are constantly brought before your notice in reporting on the necessity of peremptorily closing the shallow wells of this neighbourhood.

Total solid matter, or solid impurities, in a town supply, according to Hassall, Parkes, Angus Smith, and others, should not exceed 18 to 20 parts per 100,000, even if no lime salt other than carbonate be present. Sulphate of lime should not exceed 7 parts per 100,000, as it means permanent hardness, &c. Magnesia, as carbonate, and nitrate, which practically are the only natural forms in which these salts are found in water, should not exceed 3 parts per 100,000. Chloride of calcium, alkaline carbonates, chloride of sodium, and potassium, should not exceed 2 parts per 100,000, unless undeniably derived from sea spray or salt beds; if it comes from sea water it is quite as objectionable as

from sewage sources, because it will be accompanied by chloride and bromide of magnesia, sulphate of lime, &c. Parkes puts the limits of solid matter in a usable potable water at 40 parts per 100,000, Wanklyn 50 parts per 100,000; Hassall does not state the limits, but says 20 parts per 100,000 for a town supply. The symptoms referable to an excess of hardness arising from the presence of earthy salts are mainly of a dyspeptic character. According to Dr. Sutherland, the use of hard waters produce constipation and obstruction; and an excess of calcium and magnesian sulphates, 10 or 14 parts per 100,000, diarrhœa. A special disease that seems intimately connected with the mineral ingredients of water is goitre. Permanent hardness of water renders it also undesirable for washing purposes.

Albuminoid ammonia (Wanklyn, Chaplin, and Smith's process) is that portion of the combined nitrogen of organic matter which can be converted into ammonia by boiling the water in the presence of a large excess of an alkaline solution of permanganate of potash. Urea is not affected by it, and even albumin, which is probably much in the minority of the nitrogenous residuis of food, is not entirely converted (that is to say the nitrogen thereof) into ammonia. According to Wanklyn, one of the originators of the process, the albuminoid ammonia if amounting to ·01 per 100,000 is very suspicious, and ·015 should condemn a water absolutely.

Free ammonia is derived from the breaking up of easily destructible nitrogenous compounds (teurra uric acid) and should not exceed ·01 per 100,000 organic nitrogen, and this, or albuminoid ammonia and free ammonia, should be taken together when considering the condition of a water.

Nitrogen as nitrates and nitrites represents the quantity of nitrogenous (that is the nitrogen which existed therein) matter which has been oxidised either by the assistance of a porous subsoil, or without such assistance.

The previous sewage or animal contamination is calculated from the nitrates and nitrites, thus .032 (which represents the amount found in rain water) is subtracted from the sum found, and the remainder is multiplied by 10,000. For instance, supposing a water contained 2·032 of nitrogen as nitrates and nitrites, then, after taking away the quantity found in rain water, there would remain 2 parts per 100,000, which multiplied by 10,000 gives 20·000 as the previous sewage or animal contamination. It was found by numerous experiments that the London filtered sewage (in the same condition, of course, as the London sewage was at the time the experiments were performed) contained 10 parts of nitrogen, capable of becoming oxidised and converted into nitrates and nitrites

Chlorine, when present in quantity less than 3·0 parts per 100,000 is not out of place, and when derived from a natural source is not deleterious in any reasonable quantity, but if nitrates or nitrites are present with free ammonia and organic carbon and nitrogen, or free ammonia in large amounts it is an indirect indication of sewage contamination.

Hardness. The temporary hardness is that which is removed by boiling the water for half an hour and making the volume up with distilled water to that which was first taken. The hardness of water is due

to lime and magnesia in combination with no matter what acid, thus nitrate, carbonate, sulphate, butyrate, or chloride of either lime or magnesia confer the property of hardness upon a water, but the actual amount of such hardness will depend upon the combining weight of the acid. The weight of a molecule of carbonate of lime (which is taken as the standard of hardness) is 100. The weight of a molecule of sulphate of lime is 136, a molecule of chloride of calcium weighs 110; therefore it will take 136 grains of sulphate of lime or 110 grains of chloride of calcium to give 100 degrees of hardness or 164 grains of nitrate of calcium to give 100 degrees of hardness. The great objection to these soluble salts of lime and magnesia is, that in addition to their medicinal and other properties they are not precipitated by boiling, and confer permanent hardness upon a water. On reflection, it will be seen, therefore, that the estimation of the permanent hardness of a water is of greater moment than is commonly attached to such a determination. If the permanent hardness be considerable, there must be salts of lime and magnesia present, and the operator can easily judge from the determination whether or not magnesia is held in solution, and from a careful comparison of the ordinary result of analysis he can, without making an analysis of the constituents, predict with great reliability as to the manner in which the acids and vases are combined. The *total hardness* of a sample in its ordinary condition, according to Hassall, should not exceed 14 per 100,000, leaving a permanent hardness of 3 parts per 100,000. Water, giving a total hardness of about 40 parts and a permanent hardness of 30 parts per 100,000 is useless for domestic purposes, and it is to be regretted that the poorer classes should be compelled to waste such large quantities of soap, destroy the fibre of their clothing, and be unable to wash them effectually through the use of the excessively hard water which is supplied by the wells of this Borough. The hardness of the Cardiff Water Works supply is certainly high, and in that respect objectionable but can be much reduced by boiling. The hardness of the well water is not only *very excessive*, but is to a very great extent permanent.

The conclusions to be drawn from an analysis; and the figures to which importance is to be attached. Wanklyn states the estimate of chlorine, solid matter, free, and albuminoid ammonia are sufficient to judge whether a water is fit for drinking; others attach considerable importance perhaps more so to nitrates and nitrites, phosphoric acid, and hardness. It was eliminated in a recent discussion after a lecture delivered by Dr. Frankland on water analysis, that in order to judge of the characters of a water, it was absolutely essential to get all the evidence obtainable, and these weigh, not one, two, or three, *but all* the results together and draw the conclusions therefrom. When the chlorine reaches 4 parts per 100,000, and the nitrates 3 parts per 100,000, with, or without much free, and albiminoid ammonia, or organic nitrogen, no one would hesitate to condemn such a water absolutely. What can be more repugnant to the human mind than the knowledge that one is actually drinking the liquid accompaniments of the excrements of the neighbourhood?—no matter how altered by filtration and oxidation they may be, and the fact that no one would venture an opinion that the germs of disease are removed by the most active filtration, is, of itself, sufficient to show that those who attach no importance to the presence of chlorine and nitrates, or the

oxidation produets of sewage, do it, not so mueh from eonvietion, but that the trouble and difficulty of having recourse to tedious and true scientific work.

Having thus given in detail the standards from whieh the fitness or unfitness of a water for drinking or domestic purposes may be determined, I may apply these as comparative tests of the shallow well water of this district. Shallow wells are at all times to be regarded with great suspicion, owing to the circumstance that the surrounding soil is likely to be saturated with impurities to such a degree that it is impossible the water can escape pollution. This is especially the case in a crowded locality like Canton. With its hitherto almost entire absence of drainage, and with a subsoil of light porous gravel lying on a bed of impermeable clayey gravel, pent up on the south by a bed of heavy marine elay, it must, necessarily happen that the subsoil is thoroughly saturated with sewage matter. The contents of the cesspools, which are constantly full, even to overflowing, with excremental liquids, can but find their way into those shallow wells, which being sunk into the impermeable clay, become simply catchpits for the deposit of sewage matters. As an instance of the saturation of the subsoil: on recently visiting and inspecting the drainage works being carried on in this neighbourhood, I found, on examination, that the subsoil was blackened by sewage percolation, and the nausea, consequent on this, was so great as to be scarcely endurable by the workmen employed there. Although this was at a considerable distance from any cesspool it left no doubt as to the source from whence the polluting matter came. This condition of things appertains, to a greater or lesser degree, throughout the whole of the Urban Sanitary District of Cardiff, and is simply modified by the greater or lesser amount of past or present drainage.

I now insert a Tabular Statement of the samples of water taken as specimens throughout the whole district, and analysed by Mr. Thomas, the borough analyst, for the purpose of enabling you to form a judgement on the data on which I have always asked your board for authority to take proceedings for the peremptory closing of these polluted wells.

CARDIFF LABORATORY.

Results of Analyses of samples of Water, expressed in parts per 100,000, by J. W. THOMAS, F.C.S.

Description.	Total solid Impurities.	Albuminoid Ammonia.	Free Ammonia.	Nitrogen as Nitrates and Nitrites.	Previous Sewage or Animal Contamination.	Chlorine.	HARDNESS.			REMARKS.
							Temporary.	Permanent.	Total.	
Water from Rowe's Square	91·8	·012	0	3·774	37,400	15·45	10·2	30·7	40 9	Clear.
Pump in Millicent Street	96·0	·015	·011	4.27	42,400	12·8	11·9	34·6	46·5	Clear.
Pump in Elm Street	82·8	·014	·0052	4·107	40,750	4·25	5·8	37·0	42·8	Rather turbid.
Pump in Spring Gardens	133 8	·018	·0166	6·695	66,620	16·15	25 2	52·6	77·8	Nearly clear.
Pump in Crwys Bychan	144·1	·06	·213	1·914	18,820	57·0	18·6	26·4	45·0	Turbid.
Pump in East Street, Canton	66·4	·011	·0292	3·015	29,830	5·6	9·2	26·5	35·7	Turbid.
Pump in Devonshire Place...	94·4	.006	·0026	6 292	62,600	11.2	14·0	38·5	52·5	Clear.
Pump in Canton Square	52.3	·020	.008	1·550	15,200	4·5	17 3	15·5	32·8	Nearly clear.
Pump in Railway Terrace	40·0	·026	·030	·724	6,920	4·9	4·0	17 0	21·0	Nearly clear.
Limit of impurity standard	40·0	·015	·010	·100	·700	3·0	5.0	24·0	29·0	Nearly clear.
Recommended standard of purity ...	20·0	·004	·002	·050	Nil.	1·5	14·0	3·0	17·0	Clear.

It has been brought to my notice on several occasions when I have taken proceedings for the peremptory closing of these wells, that owners bring specimens of water, and object to the closure on the ground that the water is clear and palatable, in fact, tasteless; and urge that under such circumstances sewage contamination, or organic matter, could not exist in the water. This idea is very erroneous, and dangerously fallacious. The refined methods of analysis brought out of late years have been the means of proving beyond dispute that the properties referred to are of very secondary value, as it is possible, and such of every day finding, that a water may be highly charged with organic matter, and the elements of sewage pollution, and yet be inodorous and colourless—in fact, the more highly charged a water is with oxidation properties of sewage, the more palatable, and, as a rule, the more clear it is; while, if it be highly polluted, the presence of alkaline carbonates renders the water brisk and aerated, the nitrates giving it an agreeable saline taste. It was under such circumstances the celebrated well water at Soho obtained its notoriety for its supposed excellence; and was sought after, far and near. When the cholera epidemic of 1848 spread with alarming mortality in this neighbourhood, the cause for a time baffled all enquiries, until the attention of Dr. Snow was directed to the condition of the water contained in this well. It was then found to be excessively polluted with organic matter—that the mortality of the neighbourhood was confined to those who drank the water—and that a similar mortality was experienced by those who, living at a distance, sought their water supply from the neighbourhood.

THE DWELLINGS OF THE WORKING CLASSES.

The condition of the lodging-houses and dwellings of the working classes during the past year has also much engrossed my attention, inasmuch as the chief excitant cause of typhus fever is produced by an unwholesome state of dwelling and the vitiated atmosphere arising from overcrowding. The Censuses of 1861 and 1871 gave an average of 6·5 and 6·6 relatively to each house, the greater number being found to exist in 1871. I have every reason to believe that average is maintained at the present time, and it may suggest itself to your mind that overcrowding to a serious extent obtains in Cardiff, the average of the kingdom as regards town populations, being 5. But such is not the case. As I have mentioned in former reports, the dwelling-houses of the working classes are built on leasehold tenures, and ground rents are excessively high. To overcome this difficulty the house proprietor and builder erect buildings considerably larger than in other towns, so that few can be considered overcrowded if giving accommodation to more than one family. A careful admeasurement is taken of the size and number of all rooms in each house, distinguishing sleeping rooms from day rooms, and a register of them is kept. In any house containing more than one family no sleeping room is permitted to be occupied during the day, and effective ventilation is therefore of easy application; the total cubic space allowed for each inmate is 400 feet. A most rigid and careful supervision of these houses is maintained by your Inspectors, whose

duty it is to furnish me with the following report, duly filled up, at nine o'clock every morning, tho form being one adopted by myself, and has been in use for some years :—

Morning Report of Inspector of Lodging-houses to Medical Officer of Health.

Date,

No. of House and Street.	Name of Occupier.	Number of Families.	Inmates.			Remarks.
			Adults.	Childn	Total.	
1, Ellen St .	A. B.	2	4	5	9	Clean
2, „	C. D.	3	6	7	13	Overcrowded
3, „	E. F.	2	4	5	9	Cesspool defective
4, „	G. H.	2	4	3	8	Refuse matter on premises
5, „	I. J.	2	4	6	10	Water obtained from pump
6, „	K. L.	2	4	6	10	House requires limewashing
7, „	M. N.	3	6	8	14	House dirty, a case of sickness in the house
8, „	O. P.	2	4	5	9	Animals kept on premises in an offensive state

Signed,

Inspector Lodging-houses East District.

All nuisances arising from over crowding, unwholesome condition of house, accumulation of refnse matter, defective drains, animals, (so kept as to be a nuisance,) and nuisances arising from offensive trades are immediately detected, and the necessary steps taken to remove them.

DISEASED AND UNWHOLESOME FOOD.

A constant supervision has been made over the meat and food supply. This has been found highly necessary, as thc low price is a temptation to the poor to purchasc diseased or unwholesome food. The vigilance of your Inspectors and the severities of the penalties inflicted by the Magistrates have materially supressed this evil and the importation of diseased meat, formerly a matter of frequent occurrence, is now rarely attempted. Since the "Adulteration of Food Act" has come into operation a public analyst has been appointed and I can but record the active co-operation I have received from Mr. Thomas (who fills that office in this town,) upon every occasion that I have found it necessary to avail myself of his services, and I can testify to the extreme care and the highly scientific manner in which he discharges his duties under this Act. During the prevalence of the foot and mouth disease among cattle his services were most valuable in detecting the milk of cows suffering from that epidemic, when offered for sale, and now that diseased milk is known to be a fertile source of typhoid fever, I anticipate still greater benefits to the public health. The subject of a proper registration of cow sheds has lately been brought before your notice by Mr. Moir, V.S., the Cattle Inspector of this district, with the view of getting these placed under proper Sanitary regulations, and I trust his suggestions will be adopted with as little delay as possible.

THE SANITARY AND VITAL STATISTICS.

THE POPULATION.

To enable me to form an estimate of the population of the Cardiff Urban Sanitary District—I caused another very careful survey of the whole of it to be made by the two Sanitary Inspectors during the months of November and December last, so as to ascertain the number of inhabited houses. By calculating the average number of inmates te each house found in the censuses of 1861 and 1871, these being 6·5 and 6·6 respectively and applying these averages to the inhabited houses existing in Cardiff in 1876, a very reliable approximation can be arrived at.

On this basis, the population subdivided into districts, may bo taken to be as follows:—

The Subdivision of Cardiff	40114
Ditto Roath	18066
Ditto Canton	12561
The average number of Seamen in Port ...	4000
Total	74741

The equation recommended and followed by the Registrar General in calculating the yearly increase of a population is inapplicable to this district, as it has been within the last two years considerably increased, owing to the absorption of the two Urban Sanitary districts of Roath and Canton; both of these two districts have increased to a degree rarely equalled by any other of the towns of the Kingdom. Moreover, at the period of the census of 1871, each district was simply the populous portion of the two parishes of Roath and Llandaff. By this amalgamation the whole of the parish of Roath, and only a portion of Llandaff, have been included in the Cardiff Urban Sanitary district, and no defined population can be found in the last census on which to base an estimate.

The estimated number of seamen in the port is taken to be the same as that observed in 1871. The total tonnage of vessels in the Port was in 1876 considerably in excess of any previous year, as furnished by the return kindly given me by Mr. T. S. Miller, H.M. Collector of Customs, Cardiff; the average may therefore be considered to be certainly equal, if not more than 1871.

YEAR.	No. of Vessels Inwards.		Total No. of Vessels Foreign and Coastwise.	TONNAGE.		Total Tonnage, Foreign and Coastwise, Inwards.
	Foreign.	Coastwise.		Foreign.	Coastwise.	
1871	4,234	6,919	11,133	1,637,725	588,011	2,225,736
1872	4,942	6,994	11,836	1,951,897	600,805	2,552,702
1873	4,694	6,674	11,368	1,920,410	640,089	2,560,499
1874	4,966	6,210	11,176	2,113,987	545,692	2,659,679
1875	4,645	5,541	10,186	1,947,265	493,818	2,441,083
1876	5,511	6,957	12,468	2,367,307	601,240	2,963,547

The Births registered in this district during the year, distributed over the quarters, were as follows:—

	QUARTER ENDING								Total.
	March.		June.		September.		December.		
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	
Cardiff ...	194	166	210	147	190	195	192	166	1460
Roath	111	93	92	90	80	93	132	92	783
Canton ...	63	55	50	53	73	57	48	65	464
Total ...	368	314	352	290	343	345	372	323	2707

There have been 746 Marriages, being a decrease of 95 compared with the previous year. The depressed state of trade probably oxercised an unfavourable influence on matrimony throughout the kingdom, especially in those districts more or less dependent on the iron and coal trades. In the third Quarterly Report of the Births, Deaths, and Marriages, for the year 1876, the Registrar-General alludes to this circumstance, and states, "The Marriages in the third quarter of 1876, compared with the three corresponding quarters, showed the largest proportional decrease in the Northern counties, and in South Wales, where the population is principally engaged in mining."

The Deaths during the year were 1,455, being registered as under:—

	Cardiff.	Roath.	Canton.	Total.
Quarter ending March	300	70	44	414
" " June	244	63	51	358
" " September	222	72	45	339
" " December	229	54	61	344
	995	259	201	1455

The following Table is a comparative return of Births, Deaths, and Marriages in the district of Cardiff for ten years and 1876, the two later years being after the district was enlarged:—

Year.	Estimated Population.	Marriages.	Births.	Birth Rate per 1000 Population.	Deaths.	Death Rate per 1000 Population.
1866	36,246	539	1331	36·8	882	24·3
1867	39,904	601	1397	37·8	873	23·5
1868	37,562	586	1387	36·8	843	22·5
1869	38,220	585	1414	39·9	1,005	26·2
1870	38,878	578	1406	36·1	903	23·2
1871	39,536	558	1391	35·6	891	22·5
1872	40,431	658	1358	33·5	916	22·6
1873	41,326	741	1430	34·1	995	21·3
1874*	42,221	812	1550	36 7	885	23·5
1875	72,760	841	2716	37·3	1,547	21·2
1876	74,741	746	2707	36·2	1,455	19·1

* After 1874 the amalgamation of three districts, Cardiff, Roath, and Canton, took place.

I may here state that the comparatively little increase in the total Marriages, since the year 1874, when the district was enlarged, may be explained by the circumstance that the Marriage returns up to 1874 included all Marriages which took place at the Registrar's office, Cardiff, whether the parties were resident in Cardiff or not. On the amalgamation of the district the addition would simply be those solemnized at the several places of worship at Roath and Canton.

The total Births registered during the year at Cardiff being 2,707, the birth rate has been 36·2 per 1,000, that of the Kingdom being 36 5.

The total Deaths during the same period being 1,455, the death rate was 19·1 per 1,000, the death rate of the Kingdom 22·8.

The following Table gives the death rate of Cardiff at each quarter of the year, compared with that of the Kingdom, distinguishing Urban from Rural districts:—

	March.	June.	September.	December.	Year.
Cardiff	22·1	19·1	18·1	18·4	19·1
For 134 Districts, and 57 Sub-districts, comprising the chief towns	25·3	22·1	21·7	21·9	22·8
In the remaining Districts and Sub-districts of England and Wales, comprising chiefly small towns and country parishes.....	21·7	19·2	16·7	17·3	18·6

The total mortality of the Cardiff Urban Sanitary District during 1876 has been 92 less than the previous year, and but for the continued prevalence of scarlatina, the mortality table would have been exceedingly satisfactory; as it is, it contrasts very favourably with that of the Kingdom, being 3·7 per 1,000 less than the Urban population, and only ·6 per 1,000 in excess of the Rural districts.

Of the 1,455 Deaths, 828 were males, and 527 females. The registered causes of death are given in the Tabulated Appendix No. 1, distinguishing the deaths from each disease at the periods of life in accordance with the analytical tables of the Registrar-General.

Table No. 2, Appendix, illustrates the death rate from each disease, as compared with that of the Kingdom during the decennial period ending 1874, being that given in the last Report of the Registrar.

The Registrar-General, in his elaborate and most valuable statistical reports on the mortality of the kingdom, enumerates seven which he describes as the chief zymotic diseases. These are diseases especially due to preventable or removable causes. Annexed is a table extending over a period of 10 years ending December, 1875, and the year ending December, 1876, giving the proportionate rate of mortality in Cardiff and the entire kingdom. By this table it will be seen that while the total deaths in Cardiff in 1876 were considerably less than those of the large towns or those of the kingdom, there had been a considerable excess in the zymotic class of diseases, this excess being due to the prevalence in a very severe form, of one of the infantile epidemics, which appears from time to time in a district, and when so it materially affects the rate of mortality.

Table, illustrating Deaths from seven chief Zymotic Diseases, for 10 years ending 1875, and the year 1876, with comparative totals of London and Kingdom.

Disease.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	Annual Average of 10 years. 1866 to 1875.	Proportion of Deaths to 1000 Deaths in 10 years. 1866 to 1875.	Total Deaths in Cardiff 1876.	Proportion of Deaths to 1000 Deaths in 1876.
Smallpox	2	0	4	4	0	13	55	8	2	1	8·9	9·0	1	·6
Measles	4	14	11	17	5	4	69	2	52	4	18·2	18·6	8	5·4
Scarlet Fever.....	23	16	21	50	26	90	15	4	13	132	39·0	40·0	201	138·1
Diphtheria	4	0	2	11	2	1	2	6	6	11	4·5	4·6	10	6·8
Whooping Cough...	15	23	10	33	29	1	20	19	12	38	20·0	22·3	25	17·1
Fever	65	32	29	25	40	28	38	27	33	38	35·5	36·4	25	17·1
Diarrhœa	78	28	30	15	31	21	35	37	36	70	38·1	39·1	69	47·4
Cardiff Total	191	113	107	155	133	158	234	103	154	294	164·2	149·8	339	232·9
London	14,760	11,660	14,925	17,413	16,476	19,451	12,690	11,376	11,230	14,625	14,460·	193·4	12,468	161·5
England and Wales	82,692	72,587	97,362	91,389	100,257	103,801	91,743	70,402	85,094	79,250	86,512·	171·4	73,217	143·4

These seven diseases are smallpox, measles, scarlatina, diphtheria, whooping-cough, fever, and diarrhœa.

Small-pox was fatal only in one case. This was a foreign seaman in the Hamadryad Hospital, to which institution he had been conveyed. Four other cases were reported during the year; these were all imported by the shipping, three of these being foreign seamen and one English. Immediately these were reported to me I visited the vessels and caused the sick to be removed to the Seamen's Hospital. The vessels were then thoroughly disinfected, as also the clothes of the sick, the crew carefully examined, especially in reference to previous vaccination; when this was found to be unsatisfactory re-vaccination was enforced. The vessels were then isolated, and no communication permitted with the shore until considered free from infection. In carrying out these provisions I was most cordially assisted by the Dock and Custom House authorities. None of these four cases were fatal, and no extension into the town or among the shipping took place.

Four deaths were registered from measles, the death-rate from this disease being 0·093, that of the kingdom 0·428.

The chief mortality among the zymotic diseases arose from scarlatina, which prevailed most severely throughout this district during the later months of 1875 and the whole of 1876. The deaths from this disease in Cardiff during 1876 were 201, being a death-rate of 2·6 per 1,000. Scarlatina is an epidemic associated with childhood, and from which few children escape. It makes its appearance as an epidemic at intervals, with a severity more or less marked in direct ratio to the number of children in a locality susceptible of the disease, in large towns, or even in smaller ones where sanitary provisions are neglected. It then materially disturbs the ordinary rate of mortality arising from zymotic diseases. The epidemic visitations of late years in Cardiff made their appearances in 1869, 1854, 1863, 1871, and 1875-76.

The annual average of mortality from scarlatina in Cardiff for 10 years up to, and including 1874 was 0·736—that of the kingdom during the same period being 1·038. During this period the mortality in Cardiff was less than that of the kingdom, but in the decennial period which included 1876 it rose to 1·235.

When scarlatina evidences an indication to assume large proportions, it is an epidemic of all others the most difficult to oppose with the limited powers afforded by the legislature, unless a very hearty co-operation is obtained from the general public. The *modus operandi* by which the disease is communicated is by the infectious germs of the disease given off by the skin, and floating in the atmosphere, therefore inhaled and taken into the system by those exposed to the infected air. Isolation, so important, becomes most difficult in application by reason of the limited house accommodation of a very large proportion of our population. To meet this difficulty as far as practicable, ventilation was rigidly enforced, so that a free supply of air might assist in destroying by oxidation the diseased germs. Another element of danger from these germs arises from the circumstance that

they are attracted by near surfaces, are therefore deposited on the clothes of persons living in, or visiting infected houses, and by them conveyed to others, especially by the visitation of friends, who communicate the infection to their own family; or by children from infected houses continuing their attendance at day schools, To meet the first difficulty the advice of the family practitioner, or the persuasion of the Health Officer, was too often of little avail; but one danger of this description I effectively met whenever it came under my observation, I mean that of holding wakes over children dying from scarlatina; by forbidding this custom, whenever disobeyed, I caused a notice to be served on the head of the family, that the corpse would be removed to the public mortuary by an order obtained from the magisterial authorities. This notice in every instance when served was attended with success. I also received every assistance on this, as on all other occasions, from the Catholic ministers when their aid has been sought. To prevent the danger arising from children from infected houses continuing attendance at school, I served a notice on the occupier of the infected house to prevent this, and communicated to the schoolmaster the circumstance of any scholar who was a member of an infected family. These notices were always complied with, but frequently the information was too late to be of advantage. It is under these circumstances that effective sanitary provisions can only be carried out, by the co-operation of the general public to which I have alluded. Another source of danger arises from the excreta from the body not being destroyed before disposal. To overcome this I recommended in all cases coming under my notice that chemical agents such as carbolic acid, Condy's fluid, or ferrous sulphate should be placed in the receiving vessels.

Diphtheria was fatal in 10 cases, the death-rate being 0·133 per 1,000. This disease was formerly included among the deaths from scarlatina.

25 deaths were registered from whooping cough The comparative death-rate was 0·334, that of the kingdom being 0·514 per 1,000.

There were 25 deaths from fever. These were distributed over the district as follows:—In the sub-district of Cardiff, 19; in Roath, 3; and in Canton, 3; the death-rate in the district being 0·334 per 1,000, as against 0,866 per 1,000, that of the kingdom—the death-rate from fever in Cardiff being less than one-half that of the kingdom. This presents a satisfactory contrast to that time when Cardiff was reported by the Medical Inspector of the General Board of Health to be in "a deplorable state as to its sanitary condition, and that there were certain localities of the town never free from fever." Of these 25 cases 4 were imported into the district, namely, 3 received into the Hamadryad Seamen's Hospital being sailors removed from ships immediately on arrival at the port, and one a telegraph clerk who resided near Pontypridd, but who when in good health, had been to visit his family in Gloucestershire suffering from illness; when he arrived there he found one member was dead, and others very ill with typhoid fever. He remained there the night, but the following morning, feeling sick, he left for his own home. On reaching Cardiff he was too ill to proceed further, and died of the fever after 17 days'

illness. Upon enquiry I elicited the fact that after he left his mother died, and an examination of the water supplied to the house revealed the fact that an escape of sewage from a near drain had found its way into the well and polluted the water.

During the month of April my attention was called to Ebenezer Court, where fever was prevalent. On visiting it I found 1 child was dead and 2 others had been very ill. There were two houses in the court supplied with water from a well which was stated to be bad. This was examined by Mr. Thomas, the Borough Analyst, who reported it as polluted with sewage contamination. Proceedings were upon this report, taken before the authorities, and a peremptory order made for the closing of the well.

In November some severe cases of fever were reported to me at Devonshire Place, Canton. On visiting this locality I found that at No. 15 an adult aged 45 had died from enteric fever, and that three others were ill in the immediate locality. I examined the houses. These were all in a satisfactory condition, and occupied by respectable tenants. Upon onquiry I was told that the houses were supplied with water from a well which was found to be at times bad, and that it was supposed to be polluted by a cesspool in the adjoining premises belonging to a public-house. I visited these premises, which were in a most filthy state. The cesspool, as was stated, was within a few yards of the well. The surface of the premises was covered with manure heaps and refuse vegetable and other matter, pools of stagnant fœtid water containing the washings of sour beer-barrels, and a large surface sewer reaching from the extreme end of the garden to the front of the house, was filled with the soakings from styes, where a large number of pigs were kept. The subsoil was of a light porous nature, and easily allowed filtration into the well. A sample of water was analysed, and found to contain a considerable amount of sewage contamination. Proceedings in this case were also taken, and the necessary order made for closing the well. In the meantime a second case of fever had been fatal.

On visiting other localities where fever had been reported to me, I found that in many instances the houses were in a satisfactory state, as also the general condition of the premises, but the water-closets and privies were badly supplied with water for flushing purposes, being dependent on water to be carried and thrown down when used, this left to individual care, I need hardly say was very imperfectly done, and the escape of sewer gas would be very offensive even at a considerable distance and a source of danger to anyone breathing it. It is very desirable some means should be adopted to remedy this evil, as I frequently attributed the causation of fever to it.

The mortality from diarrhœa was 69, being 0·923 against 0·890 per 1,000—that of the kingdom. It was therefore slightly in excess. A considerable majority of the cases occurred in July, August, and September—the period when autumnal diarrhœa is very prevalent, and—chiefly infantile. Thus 52 were under the age of 1 year, 4 under 2 years, and 1 under 5 years.

The other deaths from zymotic diseases were few.

The subjoined table gives the total deaths, with proportionate death-rates from certain classes of disease, in the form recommended by the Associated Officers of Health. The first class I have already commented on in this report.

	Total Deaths.	Deaths per 1000 of Population.	Proportion of Deaths to 1000 Deaths.
1. Seven Principal Zymotic Diseases...	339	4·5	232·0
2. Pulmonary Diseases (*other than Phthisis*)	168	2·2	108·0
3. Tubercular Diseases...	207	2·7	142·2
4. Wasting Diseases of Infants ...	51	0·6	35·0
5. Convulsive Diseases of Infants ...	128	1·5	87·9

NOTES.

1. Includes Smallpox, Measles, Scarlet Fever, Diphtheria, Whooping Cough, Fever, and Diarrhœa.
3. Includes Phthisis, Scrofula, Rickets, and Tabes.
4. Includes Marasmus, Atrophy, Debility, want of Breast Milk, and Premature Birth.
5. Includes Hydrocephalus, Infantile Meningitis, Convulsions, and Teething.

The deaths from pulmonary diseases are below the average; these deaths have been from acute inflammatory attacks, which are more prevalent during the months of early spring, when the atmospheric influences (such as great variation of temperature) operate unfavourably.

Tubercular diseases have become sensibly less fatal during the last few years, especially the deaths from phthisis. The mortality from phthisis has no doubt been materially diminished by the improved drainage of the district. This is in accordance with the views propounded by Dr. Buchanan, whose very valuable researches have thrown great light on the causation of disease. In a district locally constituted as Cardiff, where the whole of the southern portion has a subsoil of stiff marine clay exceedingly retentive of water, the atmosphere can but be predisposed to damp, cold, and frequent fogs. According to that eminent authority this is calculated to produce a high rate of mortality from phthisis; and as the extension of drainage of the low ground in the immediate neighbourhood is yearly carried out to a greater degree, we have reason to expect a corresponding diminution in the mortality from this disease.

The wasting diseases and convulsive diseases of infants have been less fatal during 1876 than in previous years.

Violent deaths are necessarily proportionately large in this district—where such extensive docks exist, and where large works are carried by exposing those employed to the chances of serious accidents. Moreover, all accidents throughout the eastern portion of Glamorganshire are to a great extent brought into our Infirmary for treatment.

The deaths in Institutions during the year were:—

In the Infirmary...	46
Ditto "Hamadryad" Hospital	16
Ditto Workhouse	80
Ditto Gaol	5
Total	147

The deaths at tho several periods of life were:—

Under 1 year	398
Above 1 and under 2 years...	129
„ 2 „ 5 „	129
„ 5 „ 15 „	115
„ 15 „ 25 „	79
„ 25 „ 35 „	99
„ 35 „ 45 „	144
„ 45 „ 55 „	109
„ 55 „ 65 „	123
„ 65 „ 75 „	69
„ 75 „ 85 „	50
„ 85 „ 95 „	8
„ 95 years	3
Total	1,455

Infantile mortality, or deaths under 1 year, has been less in Cardiff during the year than the average ruling the Kingdom, thus out of 2707 births, 398 died under the age 1 year, being 143·3 per 1,000; that of the Kingdom being 146.

The following is a report of the Sanitary Work reported, and carried out under the two Inspectors:—

Overcrowded houses reported	284
Summoned for non-compliance	63
Penalties inflicted, varying 10s. to 40s.	53
Cautioned and dismissed	10
Houses and premises visited by day and night	13,507
Houses ordered to be cleansed	524
Meat seized and destroyed	1,687 lbs.
Fish—Mackerel	25 pads.
Fowls...	26 lbs.
Persons summoned...	11
Penalties inflicted, varying 10s. to £5	10
House drains ordered to be cleansed and repaired	604
Privies and water closets ordered to be cleansed or repaired	237
Order for removals of manure and refuse matter	307
Order for animals improperly kept	39
Houses disinfected	96
Packets of clothes and bedding disinfected	78
Wells ordered to be peremptorily closed	39
Number of houses to be supplied with water	125

In conclusion, I have especially to bring before your notice the very effective aid I have invariably received from your two Sanitary Inspectors, Messrs. James and Gover, and I can but speak in strong

terms of the meritorious manner in which they unhesitatingly discharged their duties (not unattended with personal risk) of removal of patients suffering from infectious diseases when necessary to the fever hospital, and the careful way they disinfected houses, clothes and bedding.

I have the honour to be, Gentlemen,

Your obedient Servant,

H. J. PAINE, M.D.,

Medical Officer of Health Cardiff Urban Sanitary District.

William Lewis, Steam-Printer, Duke Street, Cardiff.

APPENDIX.

TABLE No. 1.

Deaths Registered at several groups of Ages from Different Causes during the Year 1877.

CAUSE OF DEATH.	AGES. 0 to 1	1 to 2	2 to 5	5 to 15	15 to 25	25 to 35	35 to 45	45 to 55	55 to 65	65 to 75	75 to 85	85 to 95	95 & upwards	Total under 5 years	Total.
CLASSES.															
I. Zymotic Diseases	117	57	94	70	12	16	9	8	6	6	4	0		268	399
II. Constitutional Diseases	46	27	13	18	29	32	50	41	20	6	3	0		86	291
III. Local Diseases	140	36	19	18	19	28	56	56	77	34	15	1		195	499
IV. Developmental Diseases	79	3	0	0	0	1	6	0	2	14	22	7	3	82	137
V. Violent Deaths..	15	6	3	9	18	20	20	3	12	9	6	0		24	121
Not specified or ill defined	1	0	0	0	1	2	3	1	0	0	0	0		1	8
Totals	398	129	129	115	79	99	144	109	123	69	50	8	3	656	1455
CLASS I. ZYMOTIC DISEASES.															
ORDER 1.—MIASMATIC.															
1. Smallpox	0	0	0	0	0	0	1	0	0	0	0	0		0	1
2. Measles	2	4	0	2	0	0	0	0	0	0	0	0		6	8
3. Scarlet Fever (Scarlatina) ...	28	34	74	58	3	2	1	0	1	0	0	0		136	201
4. Diphtheria	2	3	2	3	0	0	0	0	0	0	0	0		7	10
5. Quinsy	0	1	2	0	0	0	0	0	0	0	0	0		3	3
6. Croup	5	2	10	3	0	0	0	0	0	0	0	0		17	20
7. Whooping Cough	14	7	4	0	0	0	0	0	0	0	0	0		25	25
8. { Typhus Fever	0	0	0	0	1	1	0	2	0	1	0	0		0	5
8. { Enteric or Typhoid F... ...	0	0	1	2	3	7	2	1	0	0	1	0		1	17
8. { Simple continued F.	0	1	0	1	1	0	0	0	0	0	0	0		1	3
9. Erysipelas	1	0	0	0	1	1	0	0	1	0	0	0		1	4
10. Puerperal Fever (Metria) ...	0	0	0	0	0	2	1	0	0	0	0	0		0	3
11. Carbuncle	0	0	0	0	0	0	0	0	0	0	0	0		0	0
12. Influenza	0	0	0	0	0	0	0	0	0	0	0	0		0	0
13. Dysentery	0	0	0	0	0	0	0	0	0	0	0	0		0	0
14. Diarrhœa	52	4	1	1	0	1	1	1	2	4	2	0		57	69
15. Cholera	0	0	0	0	0	0	0	0	0	0	0	0		0	0
16. Ague	0	0	0	0	0	0	0	0	0	0	0	0		0	0
17. Remittent Fever...	0	0	0	0	0	0	0	0	0	0	0	0		0	0
18. Rheumatism	0	1	0	0	3	2	1	1	1	1	0	0		1	10
19. Other Zymotic Diseases ...	0	0	0	0	0	0	0	0	0	0	0	0		0	0
ORDER 2.—ENTHETIC.															
1. Syphilis	7	0	0	0	0	0	1	0	0	0	0	0		7	8
2. Stricture of Urethra	0	0	0	0	0	0	0	0	0	0	1	0		0	1
3. Hydrophobia	0	0	0	0	0	0	0	1	0	0	0	0		0	1
4. Glanders	0	0	0	0	0	0	0	0	0	0	0	0		0	0
ORDER 3.—DIETIC.															
1. Privation	0	0	0	0	0	0	0	0	0	0	0	0		0	0
2. Want of Breast Milk	0	0	0	0	0	0	0	0	0	0	0	0		0	0
3. Purpura and Scurvy	3	0	0	0	0	0	0	0	0	0	0	0		3	3
4. Alcoholism { a. Del. Tremens...	0	0	0	0	0	0	1	0	0	0	0	0		0	1
4. Alcoholism { b. Intemperance...	0	0	0	0	0	0	0	2	1	0	0	0		0	3
ORDER 4.—PARASITIC.															
1. Thrush	3	0	0	0	0	0	0	0	0	0	0	0		3	3
2. Worms, &c.	0	0	0	0	0	0	0	0	0	0	0	0		0	0
Totals	117	57	94	70	12	16	9	8	6	6	4	0		268	399
CLASS II. CONSTITUTIONAL DISEASES.															
ORDER 1.—DIATHETIC.															
1. Gout	0	0	0	0	0	0	0	0	1	0	0	0		0	1
2. Dropsy	1	2	1	0	1	0	0	5	5	0	1	0		4	16
3. Cancer	0	0	0	0	0	0	8	11	10	4	2	0		0	35
4. Cancrum Oris (Noma)	0	0	0	0	0	0	0	0	0	0	0	0		0	0
5. Mortification	0	0	0	0	0	0	0	1	0	0	0	0		0	1
ORDER 2.—TUBERCULAR.															
1. Scrofula	6	3	1	3	0	1	0	0	1	0	0	0		10	15
2. Tabes Messenterica	27	9	5	0	0	0	0	0	0	0	0	0		41	41
3. Phthsis	5	1	0	9	28	31	42	24	9	2	0	0		6	151
4. Hydrocephalus	7	12	6	6	0	0	0	0	0	0	0	0		25	31
Totals	46	27	13	18	29	32	50	41	26	6	3	0		86	291
CLASS III. LOCAL DISEASES.															
ORDER 1.—NERVOUS SYSTEM.															
1. Cephalitis	2	1	1	0	1	0	2	0	0	1	0	0		4	8
2. Apoplexy	0	0	0	0	1	1	1	3	5	7	2	0		0	20
3. Paralysis	0	0	1	1	0	3	3	3	7	6	2	0		1	26
4. Insanity	0	0	0	0	0	0	0	0	0	0	0	0		0	0
5. Chorea	0	0	0	0	0	0	0	0	0	0	0	0		0	0
6. Epilepsy	0	0	1	0	2	3	1	0	0	0	2	0		1	9
7. Convulsions	67	15	6	2	0	0	0	0	0	0	0	0		88	90
8. *Brain Disease, &c.*	3	0	0	2	0	0	5	0	7	1	3	0		3	21
ORDER 2.—ORGANS OF CIRCULATION.															
1. Pericarditis	0	0	0	0	0	0	0	0	0	0	0	0		0	0
2. Aneurism...	0	0	0	0	1	1	1	1	1	1	0	0		0	6
3. *Heart Disease, &c.*	2	0	0	4	6	2	9	20	12	7	2	0		2	64
ORDER 3.—RESPIRATORY ORGANS.															
1. Laryngitis	1	1	3	0	0	0	0	0	0	0	0	0		5	5
2. Bronchitis	36	10	4	4	1	2	5	3	15	7	3	1		50	91
3. Pleurisy	0	0	0	0	0	0	1	1	0	0	0	0		0	2
4. Pneumonia	14	5	2	1	4	4	6	3	1	2	0	0		21	42
5. Asthma	0	0	0	0	0	0	1	1	3	0	0	0		0	5
6. *Lung Disease, &c.*	7	0	0	1	1	2	2	3	7	0	0	0		7	23
ORDER 4.—DIGESTIVE ORGANS.															
1. Gastritis	0	0	0	1	0	0	1	0	0	0	0	0		0	2
2. Enteritis	0	1	1	0	0	0	1	1	0	0	0	0		2	4
3. Peritonitis	0	1	0	0	0	0	1	0	2	0	0	0		1	4
4. Ascites	0	0	0	0	0	0	0	0	0	0	0	0		0	0
5. Ulceration of Intestines ...	0	0	0	0	0	0	1	0	0	0	0	0		0	1
6. Hernia	0	0	0	0	1	2	1	2	0	0	0	0		0	6
7. Ileus	0	0	0	0	0	0	0	0	0	0	0	0		0	0
8. Intussusception	1	0	0	0	0	0	0	1	1	0	0	0		1	3
9. Stricture of Intestines... ...	0	0	0	0	0	0	0	0	0	0	0	0		0	0
10. Fistnla	0	0	0	0	0	0	0	0	0	0	0	0		0	0
11. *Stomach Disease, &c.*	2	0	0	1	0	0	1	0	1	0	0	0		2	5
12. *Pancreas Disease, &c.*	0	0	0	0	0	0	0	0	0	0	0	0		0	0
13. Hepatitis	0	0	0	0	0	0	1	0	1	0	0	0		0	2
14. Jaundice	1	0	0	0	0	0	0	2	1	1	0	0		1	5
15. *Liver Disease, &c.*	0	0	0	0	0	2	2	3	9	0	0	0		0	16
16. *Spleen Disease, &c.*	0	0	0	0	0	0	0	0	0	0	0	0		0	0
ORDER 5.—URINARY ORGANS.															
1. Nephritis...	0	0	0	1	0	0	1	1	0	0	0	0		0	3
2. Ischuria	0	0	0	0	0	0	0	0	0	0	0	0		0	0
3. Bright's Disease (Nephria) ...	0	1	0	0	1	1	6	7	0	0	0	0		1	16
4. Diabetes	0	0	0	0	0	1	0	0	0	0	0	0		0	1
5. Calcnlus (Stone)	0	0	0	0	0	0	0	1	0	0	0	0		0	1
6. Cystitis	0	0	0	0	0	0	0	0	3	0	0	0		0	3
7. *Kidney Disease, &c.*	0	0	0	0	0	2	2	0	0	0	1	0		0	5
ORDER 6.—ORGANS OF GENERATION.															
1. Ovarian Dropsy	0	0	0	0	0	0	0	0	0	0	0	0			
2. *Uterus Disease, &c.*	0	0	0	0	0	0	0	0	0	0	0	0			
ORDER 7.—ORGANS OF LOCOMOTION.															
1. Synovitis (Arthritis)	0	0	0	0	0	0	0	0	0	0	0	0		0	0
2. *Joint Disease, &c.*	0	0	0	0	0	2	1	0	0	0	0	0		0	3
ORDER 8.—INTEGUMENTARY SYSTEM.															
1. Phlegmon	1	1	0	0	0	0	0	0	0	0	0	0		2	2
2. Ulcer	0	0	0	0	0	0	0	0	1	0	0	0		0	1
3. *Skin Disease, &c.*	3	0	0	0	0	0	0	1	0	0	0	0		3	4
Totals	140	36	19	18	19	28	56	57	77	34	15	1		195	499
CLASS IV. DEVELOPMENTAL DISEASES.															
ORDER 1.—DISEASES OF CHILDREN.															
1. Premature Birth	27	0	0	0	0	0	0	0	0	0	0	0		27	27
2. Cyanosis	0	0	0	0	0	0	0	0	0	0	0	0		0	0
3. Spina Bifida	2	0	0	0	0	0	0	0	0	0	0	0		2	2
4. Other Malformations	0	0	0	0	0	0	0	0	0	0	0	0		0	0
5. Teething	6	1	0	0	0	0	0	0	0	0	0	0		7	7
ORDER 2.—ADULTS.															
1. Paramenia	0	0	0	0	0	0	0	0	0	0	0	0		0	0
2. Childbirth (*see* Puerperal Fever)	0	0	0	0	0	1	4	0	0	0	0	0		0	5
ORDER 3.—OLD PEOPLE.															
1. Old Age	0	0	0	0	0	0	0	0	2	12	21	7	3	0	45
ORDER 4.—NUTRITION.															
1. Atrophy and Debility	44	2	0	0	0	0	2	0	0	2	1	0		46	51
Totals	79	3	0	0	0	1	6	0	2	14	22	7	3	82	137
CLASS V. VIOLENT DEATHS.															
ORDER 1.—ACCIDENT OR NEGLIGENCE															
1. Fractures and Contusions ...	1	0	0	4	5	8	8	0	4	1	0	0		1	31
2. Wounds { Gunshot	0	0	0	0	0	0	0	0	0	0	0	0		0	0
2. Wounds { Cut, Stab	0	0	0	0	0	0	0	0	0	0	0	0		0	0
3. Burns and Scalds	0	2	3	0	0	0	0	0	0	0	1	0		5	6
4. Poison	0	0	0	0	0	0	1	0	0	0	0	0		0	1
5. Drowning	0	0	0	4	10	11	3	1	1	1	0	0		0	31
6. Suffocation	1	0	0	0	0	0	0	0	0	0	0	0		1	1
7. Otherwise	12	4	0	1	3	1	8	2	5	7	5	0		16	48
ORDER 3.—HOMICIDE	1	0	0	0	0	0	0	0	1	0	0	0		1	2
ORDER 4.—SUICIDE	0	0	0	0	0	0	0	0	1	0	0	0		0	1
Totals	15	6	3	9	18	20	20	3	12	9	6	0		24	121
Causes not specified or ill defined ...	1	0	0	0	1	2	3	1	0	0	0	0		1	8

NOTE.—The Deaths in Public Institutions of Non-Residents are excluded.

TABLE No. 2.

The following Table illustrates the proportionate death-rate to every 1,000 living in Cardiff compared with that of all England.

		Proportionate rate to every 1000 living. Cardiff.	England on decennial period Registrar General's last Report.
CLASSES.			
I. Zymotic Diseases	399	5·3	5·
II. Constitutional Diseases	291	3·8	4·2
III. Local Diseases	499	6·6	8.4
IV. Developmental Diseases	137	1·8	3·5
V. Violent Deaths..	121	1·6	·7
Not specified or ill defined	8	0·107	...
Totals	1455	19·4	22·8
CLASS I. ZYMOTIC DISEASES.			
ORDER 1.—MIASMATIC.			
1. Smallpox	1	0·026	0·250
2. Measles	8	0·093	0·428
3. Scarlet Fever (Scarlatina) ...	201	2·6	1·038
4. Diphtheria	10	0·133	...
5. Quinsy	3	0·040	0·016
6. Croup	20	0·267	0·240
7. Whooping Cough	25	0·334	0·514
8. { Typhus Fever ... ... 5 / Enteric or Typhoid F... 17 / Simple continued F. ... 3 }	25	0·334	·0 866
9. Erysipelas	4	0·053	0·097
10. Puerperal Fever (Metria) ...	3	0·040	0·059
11. Carbuncle	...	...	...
12. Influenza	...	...	...
13. Dysentery	...	...	...
14. Diarrhœa	69	0·923	0·890
15. Cholera	...	...	...
16. Ague	...	...	...
17. Remittent Fever...	...	...	...
18. Rheumatism	10	0·133	0·109
ORDER 2.—ENTHETIC.			
1. Syphilis	8	0.107	0·063
2. Stricture of Urethra	1	0·013	0·010
3. Hydrophobia	1	0·013	0·009
4. Glanders	...	...	...
ORDER 3.—DIETIC.			
1. Privation	...	...	...
2. Want of Breast Milk	...	...	...
3. Purpura and Scurvy	3	0·040	0·018
4. Alcoholism { a. Del. Tremens...	1	0·013	0·023
4. Alcoholism { b. Intemperance...	3	0·040	0 017
ORDER 4.—PARASITIC.			
1. Thrush	...	...	...
2. Worms, &c.	3	0·040	0·055
Totals	399	5·3	5·
CLASS II. CONSTITUTIONAL DISEASES.			
ORDER 1.—DIATHETIC.			
1. Gout	1	0·013	0·015
2. Dropsy	16	0·214	0·385
3. Cancer	35	0·468	0·369
4. Cancrum Oris (Noma)	...	...	...
5. Mortification	1	0·013	0·065
ORDER 2.—TUBERCULAR.			
1. Scrofula	15	0·200	0·142
2. Tabes Messenterica	41	0·548	0·282
3. Phthisis	151	2·020	2·567
4. Hydrocephalus	31	0·454	0·370
Totals	291	3.8	......
CLASS III. LOCAL DISEASES.			
ORDER 1.—NERVOUS SYSTEM.			
1. Cephalitis	8	0·107	0·198
2. Apoplexy	20	0·267	0 477
3. Paralysis	26	0·347	0·486
4. Insanity	...	...	...
5. Chorea	...	...	...
6. Epilepsy	9	0·120	0·114
7. Convulsions	90	1·204	1·265
8. *Brain Disease, &c.*	21	0 294	0·231
ORDER 2.—ORGANS OF CIRCULATION.			
1. Pericarditis	...	...	0·029
2. Anenrism...	6	0·080	0·021
3. *Heart Disease, &c.*	64	0·856	0·899
ORDER 3.—RESPIRATORY ORGANS.			
1. Laryngitis	5	0·066	0·068
2. Broncbitis	91	1·217	1·596
3. Pleurisy	2	0·026	0·046
4. Pneumonia	42	0·561	1·163
5. Asthma	5	0·066	0·203
6. *Lung Disease, &c.*	23	0·307	0·195
ORDER 4.—DIGESTIVE ORGANS.			
1. Gastritis	2	0·026	0·038
2. Enteritis	4	0·053	0·162
3. Peritonitis	4	0·053	0·077
4. Ascites	...	...	0·035
5. Ulceration of Intestines ...	1	0·013	0·045
6. Hernia	6	0·080	0·042
7. Ileus	...	...	0·059
8. Intnssusception	3	0·040	0·014
9. Stricture of Intestines... ...	...	...	0·013
10. Fistula	...	...	0·005
11. *Stomach Disease, &c.*	5	0·066	0·128
12. *Pancreas Disease, &c.*	...	...	0·000·7
13. Hepatitis	2	0·026	0·069
14. Jaundice	5	0·066	0·069
15. *Liver Disease, &c.*	16	0·214	0·268
16. *Spleen Disease, &c.*	...	...	0·002
ORDER 5.—URINARY ORGANS.			
1. Nephritis...	2	0·026	0·018
2. Ischuria	...	...	0·005
3. Bright's Disease (Nephria) ...	16	0·214	0·078
4. Diabetes	1	0·013	0·028
5. Calculus (Stone)	1	0·013	0·010
6. Cystitis	3	0·040	0·016
7. *Kidney Disease, &c.*	5	0·066	0·114
ORDER 6.—ORGANS OF GENERATION.			
1. Ovarian Dropsy	...	...	0·011
2. *Uterus Disease, &c.*	...	...	0·045
ORDER 7.—ORGANS OF LOCOMOTION.			
1. Synovitis (Arthritis)	...	...	...
2. *Joint Disease, &c.*	3	0·040	0·004
ORDER 8.—INTEGUMENTARY SYSTEM.			
1. Phlegmon	2	0·026	0·073
2. Ulcer	1	0·013	0·023
3. *Skin Disease, &c.*	4	0·053	0·015
Totals	499	......	......
CLASS IV. DEVELOPMENTAL DISEASES.			
ORDER 1.—DISEASES OF CHILDREN.			
1. Premature Birth	27	0·361	0·604
2. Cyanosis	...	...	0·020
3. Spina Bifida	2	0·026	0 017
4. Other Malformations	...	...	0·020
5. Teething	7	0·093	0·2·6
ORDER 2.—ADULTS.			
1. Paramenia	...	...	0·004
2. Childbirth (*see* Puerperal Fever)	5	0·066	0·112
ORDER 3.—OLD PEOPLE.			
1. Old Age	45	0·602	1·373
ORDER 4.—NUTRITION.			
1. Atrophy and Debility	51	0 682	1·191
Totals	137	......	......
CLASS V. VIOLENT DEATHS.			
ORDER 1.—ACCIDENT OR NEGLIGENCE.			
1. Fractures and Contusions ...	31	0·454	0·314
2. Wounds { Gunshot	...	...	0·004
2. Wounds { Cut, Stab	...	...	0·006
3. Burns and Scalds	6	0·080	0·109
4. Poison	1	0·013	0·013
5. Drowning	31	0·454	0·111
6. Suffocation	1	0·013	0·067
7. Otherwise	48	0 642	0·043
ORDER 2.—HOMICIDE	2	0·026	0·017
SUICIDE	1	0·013	0·068
Totals	121	......	......
Causes not specified or ill defined ...	8	0·107	0·146